NUCLEAR ENERGY RESEARCH INITIATIVE

Microstructure Sensitive Design for Materials in Solid Oxide Electrolyzer Cell

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Project Description

An efficient and cost-competitive method for producing hydrogen is to split water by solid oxide electrolyzer cells (SOEC) utilizing heat and electricity from a high-temperature nuclear reactor. Two major hurdles must still be overcome: (1) improving performance and life cycle of SOECs and (2) develping a method for large-scale fabrication of uniform and efficient electrodes. To address these challenges, this project will focus on transport properties of porous media and solid oxide fuel cells, and development of a set of multi-scale mathematical tools for describing classes of microstructures that allows efficient and fast computation of material properties. The research team will fabricate gradient porous electrode materials using both aerosol assisted chemical vapor deposition (AACVD) and spray pyrolysis methods. In addition, they will conduct experiments guided by microstructure sensitive design (MSD) techniques to optimize material microstructure design for best performance.

Workscope

The following activities comprise the primary project workscope:

- Develop mathematical methods for characterizing material microstructure
- Perform experimental work for fabricating gradient porous electrodes on a large scale
- Model the cathode microstructures and fabricate samples using CVD, AACVD, and spray pyrolysis methods